Possible topics on Midterm 2 (Friday February 28 in class).

Given acceleration, find velocity and position.
13.5. Velocity and acceleration. Given the acceleration vector function and the initial velocity, find the velocity vector function. Then given the initial position, find the position vector function.
14.1. Functions of 2 and 3 variables.
14.4. Linearization of a function:
\[ L(x, y) = f(a, b) + f_x(a, b)(x - a) + f_y(a, b)(y - b). \]
Linear approximation (to estimate the value of a function at a point near a given point). Tangent plane:
\[ z = f(a, b) + f_x(a, b)(x - a) + f_y(a, b)(y - b). \]
Finding points on the graph of a function whose tangent plane is normal to a given vector \( \vec{N} \) or parallel to a given plane \( ax + by + cz = d \).
14.5. The gradient: 2 variables \( \nabla f = (f_x, f_y) \), 3 variables \( \nabla f = (f_x, f_y, f_z) \). Chain rule for paths (p. 815). Properties (p. 814). Directional derivative \( D_{\vec{u}}f = \nabla f \cdot \vec{u} \), where \( \vec{u} \) is a unit vector. If \( \vec{u} \) is not a unit vector, take \( \vec{u} = \frac{\vec{u}}{||\vec{u}||} \). Formula: \( D_{\vec{u}}f = ||\nabla f|| \cos \theta \), where \( \theta \) is the angle between \( \vec{u} \) and \( \nabla f \).
Direction of maximum rate of increase/decrease (p. 819). Finding points on the surface \( F(x, y, z) = k \) whose tangent plane is normal to a given vector \( \vec{N} \) or parallel to a given plane \( ax + by + cz = d \).
14.6. Given \( f(x, y, z) \) and \( x = x(s, t), y = y(s, t), z = z(s, t) \), the chain rule is
\[ \frac{\partial f}{\partial s} = \frac{\partial f}{\partial x} \frac{\partial x}{\partial s} + \frac{\partial f}{\partial y} \frac{\partial y}{\partial s} + \frac{\partial f}{\partial z} \frac{\partial z}{\partial s}, \quad \frac{\partial f}{\partial t} = \frac{\partial f}{\partial x} \frac{\partial x}{\partial t} + \frac{\partial f}{\partial y} \frac{\partial y}{\partial t} + \frac{\partial f}{\partial z} \frac{\partial z}{\partial t}. \]
Given a function \( z = z(x, y) \) defined implicitly by \( F(x, y, z) = 0 \), compute \( \frac{\partial z}{\partial x} = -\frac{F_y}{F_z} \) and \( \frac{\partial z}{\partial y} = -\frac{F_x}{F_z} \).
14.7. Find critical points of a function and use the second derivative test (p. 835) to determine whether they are local minima, local maxima, saddle points, or the test fails.
Given a continuous function on a closed, bounded domain in the plane, find its global maximum and minimum values and where they occur (p. 838).